

Calorimeter Beam Test 2016a

John Haggerty

Brookhaven National Laboratory

February 18, 2016



Calorimeter beam test

- First sPHENIX calorimeter beam test was T-1044 at FTBF February 2014
 - Our first use of SiPM's in calorimetry
 - First test of tilted plate HCAL (designed around 70 cm solenoid)
 - First test of scintillator-fiber EMCAL
 - Waveform digitizers and first preamplifiers we developed for SiPM's
 - Learned to analyze WD data
 - Several parasitic beam tests (TOF, GEM's)

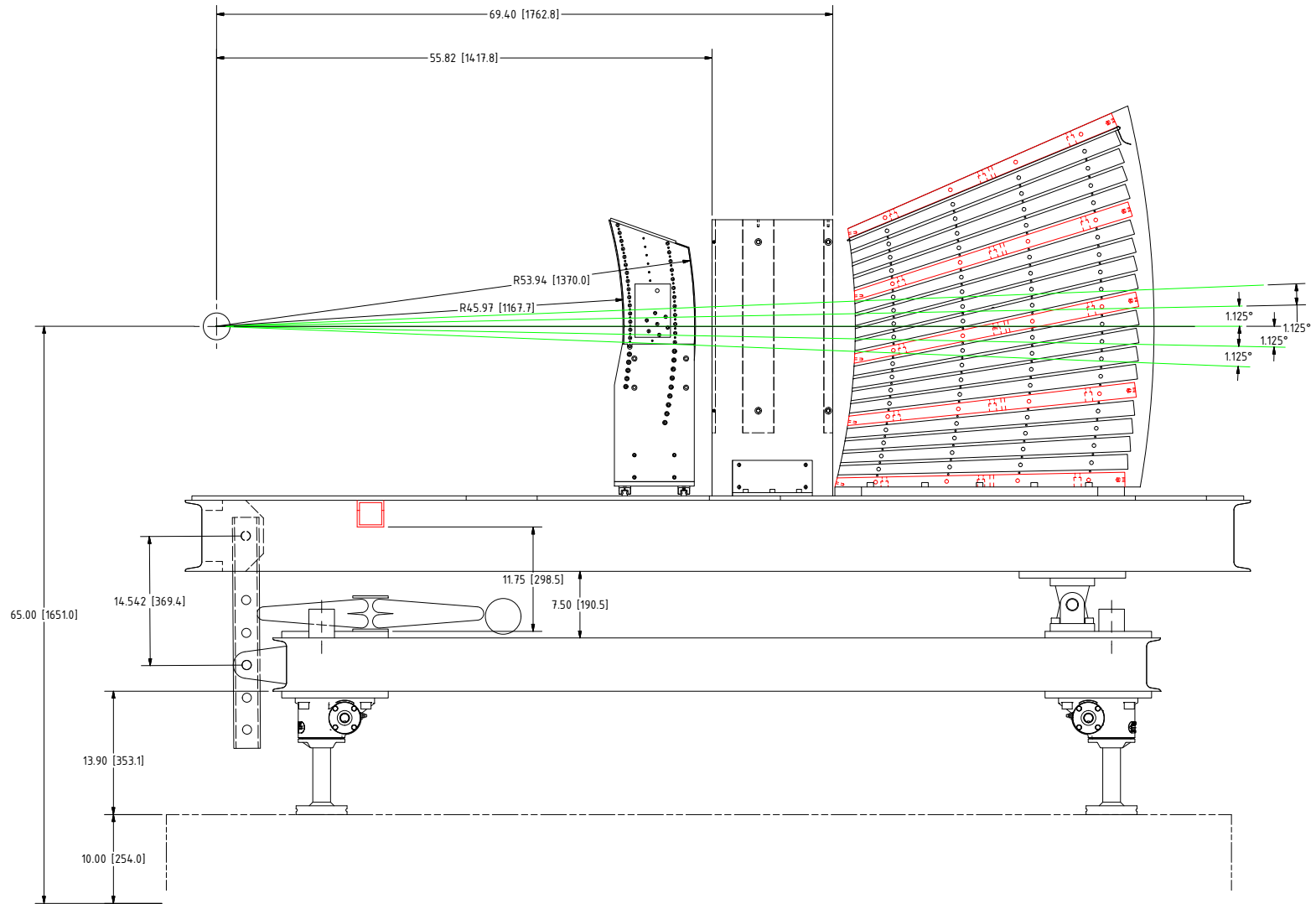


April 2016 calorimeter beam test goals

- Test HCAL geometry very close to sPHENIX with BaBar solenoid
 - Improved light collection
 - Better SiPM's (5 SiPM's/tower)
 - Improved preamps
 - Full size tiles
- First test of SPACAL of our own construction
 - Improved light collection
 - Better SiPM's (4 SiPM's/tower)
 - Improved preamps
- Primary goal is to validate the Monte Carlo simulation
 - Combined and individual calorimeter energy resolution ($e/\pi/p$)
 - Shower profiles
 - e/h separation

Detectors for the beam test

- EMCAL
 - 8x8 $\eta=0$ towers
 - 4 SiPM's/tower
 - 8x1 channel preamps/SiPM carrier boards
- HCAL
 - Inner
 - 4x4 $\eta=0$ towers
 - 5 SiPM's/tower
 - Single channel preamps
 - Outer
 - 4x4 $\eta=0$ towers
 - 5 SiPM's/tower
 - Single channel preamps



HORIZONTAL POSITION



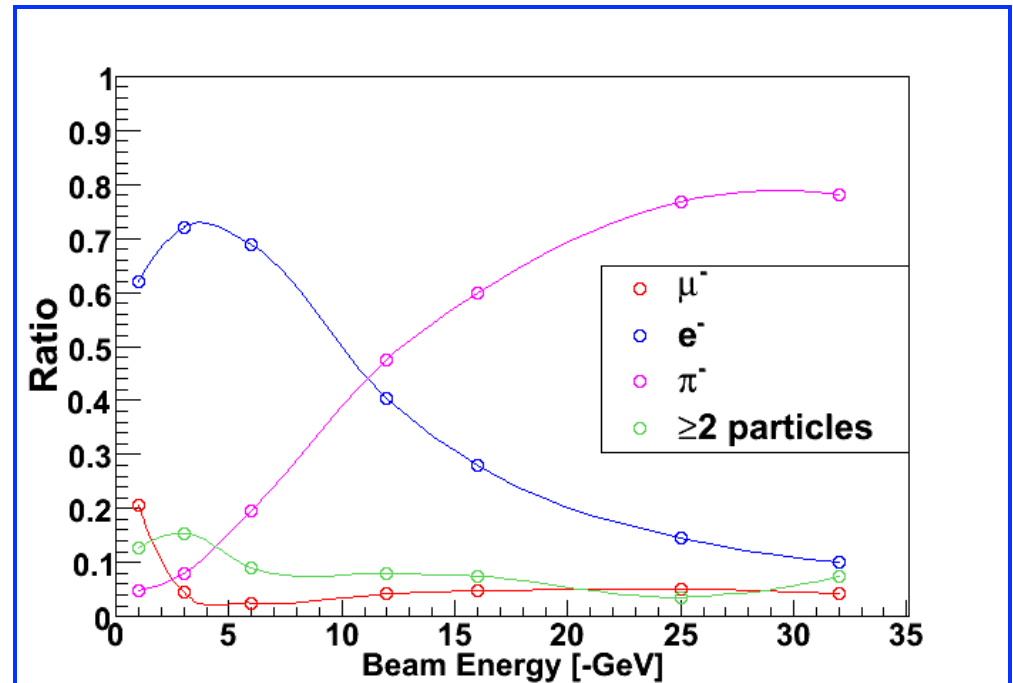
February 18, 2016

Particle Composition of MTest Beam

Tuning modes:

- 120 GeV Protons
- 32-66 GeV Pions
- 1–32 GeV Mixed Beam
- Broadband Muons from Steel absorber/target

Flux can go from about 50-5000 Hz below 8 GeV and up to 100,000 Hz for high energy tunes



Results from CALICE experiment

From Erik Ramberg

Trigger and Veto Counters

- Borrowing Oleg's hodoscope again
 - 8 x and 8 y 5 mm fingers (I think)
 - Analog signals recorded in HBD electronics
- 4 paddles around the hodoscope?
 - May as well digitize them too
- HCAL tile test
 - 2 large + 2 small
 - Can do position scan with 120 GeV beam
- Leakage counter begin OHCAL?
 - Probably not that useful, doesn't hurt
- Do we need more than the two bits from the Cerenkov counter?

Week 0 March 28-April 4

- Ship to Fermilab, ideally arriving Wednesday
- Set up on floor of Meson Lab
- Establish computing beachhead
- Training, badging, etc.
- Preliminary ORC Thursday afternoon
- If we can power everything, pedestals and LED runs over the first weekend
- Frank? Steve? Mike?

Week 1 April 4-11

- Rigging into MTEST
- Reassembly onto stand
- EMCAL far upstream with trigger counters; He tubes
- Reconnect all power and signal cables
- Walkthrough
- Begin working with beam Wednesday night or Thursday morning
- First data with PbGl and Cerenkov (PbGl in upstream EMCAL location)
- Save beam profile data from wire chambers during data runs
- EMCAL nose down first, 120 GeV p
 - A few thousand events at 8 positions
- We may not be able to read out the HCAL in this period without moving the readout racks

Week 2 April 11-18

- Complete upstream EMCAL data Mon-Tues
 - 120 GeV position scan calibration runs
 - Good statistics at 1, 2, 4, 8, 16, (32?)
 - Energy resolution
- Finish position scan of HCAL test tiles in upstream position (10 spots on large tiles?)
- Mid-week, move EMCAL
- Take small slug of data with HCAL without EMCAL
 - Probably cryostat simulator not removable
 - Just so we see beam in the HCAL
- By the end of the week, put EMCAL and HCAL in full sPHENIX configuration

Week 3 April 18-25

- Shake down combined readout and triggering
- Can we repeat the position scan on the EMCAL with HCAL behind it? If so, 12 GeV p position scan.
- Record archival energy response data sets
 - 1, 2, 4, 8, 16, 32; 120 GeV protons
 - Tilt up, tilt down, back to middle; at least two data sets in each position

Week 4 April 25-May 2

- Complete any energy response measurements that need repeating
- The more complicated goals in order of priority:
 - e-h separation measurements (IHCAL as leakage detector)
 - e/h measurements in each calorimeter segment
 - Higher statistics
 - The new electronics

Week 5 May 2-5

- Disconnect detectors
- Prepare to be rigged out
- Stow all equipment
- Copy all data back to RCF
- Pay the coffee bill

Record keeping

- Extremely important that we keep careful records
- You can't write down too much
- One minute time lapse photographs of enclosure?
- Wire chamber profiles may not be that useful, but we should have one every time we change the beam
- Repeat data sets if at all possible
- Read over the 2014 elog to get some idea what to expect:
 - <http://logbook2.phenix.bnl.gov:7815/T1044>

Monte Carlo

- We will have simulated data sets before the beam test
- Beam test plots from simulation first

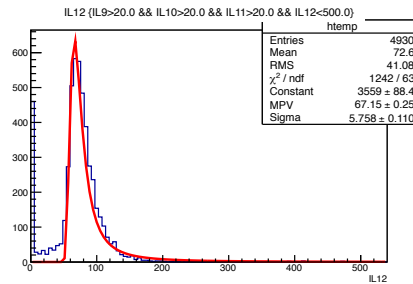
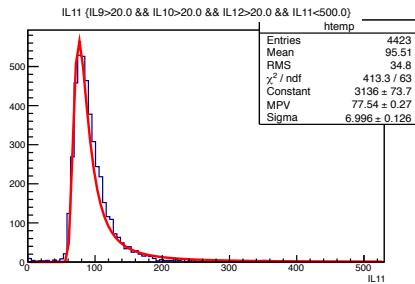
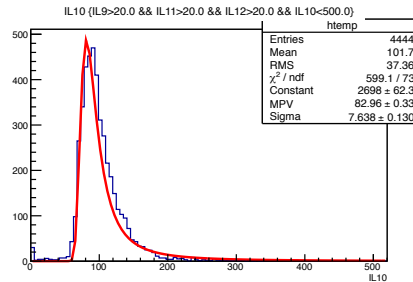
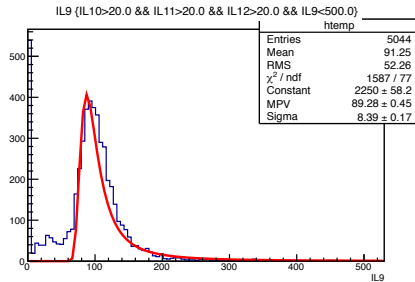
Other activities

There are a number of other groups that want to test various detectors or detector concepts parasitically with T-1044

- TOF
- RICH
- TPC
- ...

We don't want these to disrupt the calorimeter beam test, but there are a lot of shifts and we need time to digest the data

Looking good so far



Inner and outer assembled,
cosmics in inner recorded



February 18, 2016